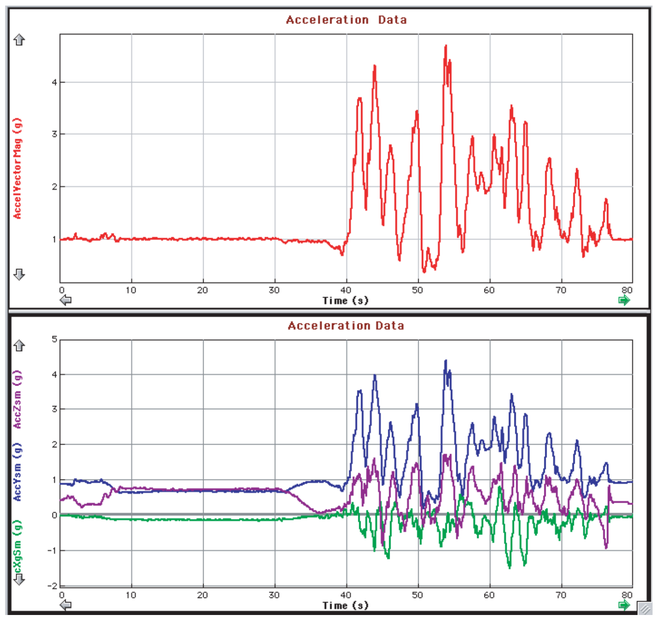
National Aeronautics and Space Administration
Glenn Research Center
Explore. Discover. Understand.

MATCH GAME

Match Acceleration Traces to Geauga Lake and Wildwater Kingdom Rides

A



Rides at an amusement park may be differentiated by the pattern of accelerations to which a rider is subjected. This acceleration experience, coupled with height, speed, and the unknown, produces an experience unique from ride to ride.

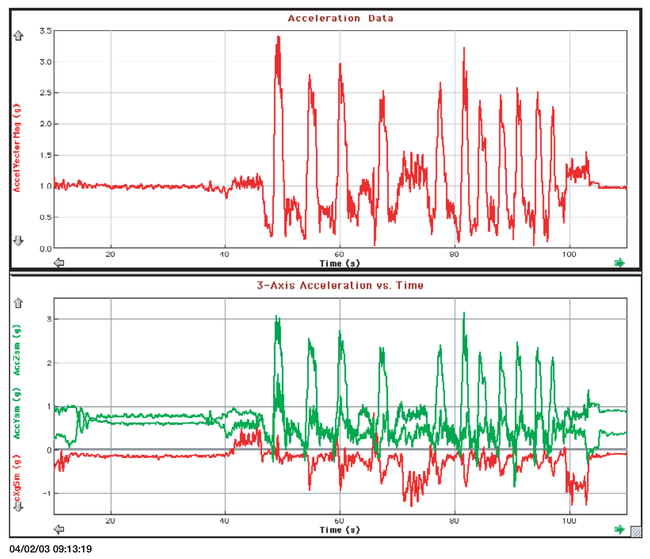
Use your knowledge of accelerations and your familiarity with the rides to match the accelerations experienced on a ride with the ride name. The "feel" of each ride is different, but the acceleration pattern may look similar. Think well and choose wisely!

Linear acceleration is a straight line acceleration quite often experienced when a ride begins and ends. This may also be felt when a brake is applied during the course of a ride, such as on a roller coaster to control the maximum speed. Centripetal acceleration is due to circular motion and quite often causes a rider to experience a force from the outer side of the car. This is found on circular rides but also can be found on roller coasters going around a curve or a turn-around.

Earth's gravitational acceleration (1g) is 9.8 m/s^2. The accelerations in these data plots were measured with an accelerometer (and thus reference frame) fixed to a rider's body.

- The X-axis is along the rider's spine with positive being downward.
- The Y-axis is along the rider's left arm with positive being outward.
- The Z-axis completes a right-handed coordinate system and is perpendicular to the rider's chest with positive being forward.
- The resultant acceleration is the vector (root-sum-square) of the three individual axes.

E



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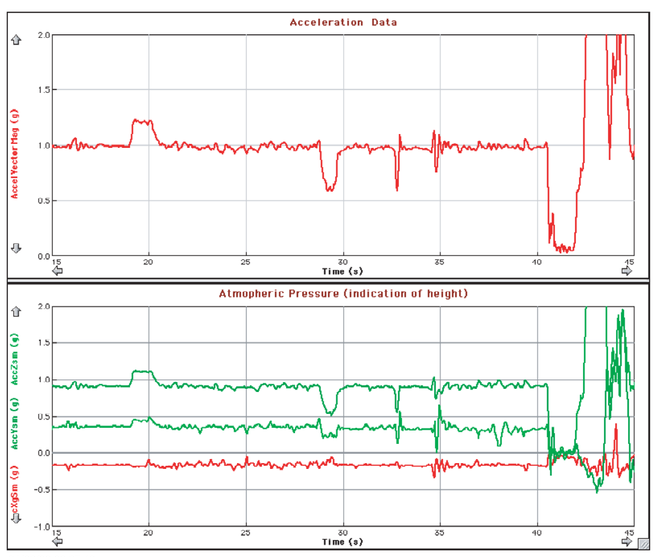
B



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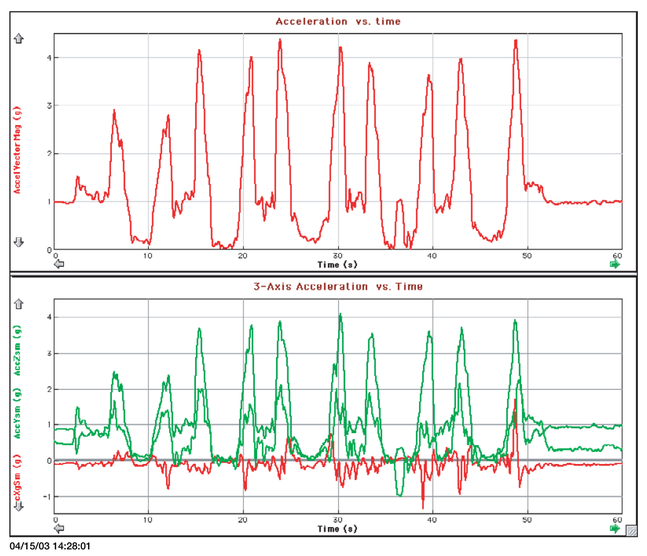
1—MR. HYDE'S NASTY FALL

Mr. Hyde's Nasty Fall is a free-fall ride where a carriage with four riders is taken vertically upward, moved horizontally about 3 meters, suspended for a few seconds, and then dropped vertically. The carriage plummets toward the ground with the acceleration of gravity. The free-fall motion is straight down until a smooth transition to horizontal motion is accomplished and the brakes are applied.

2—STEEL VENOM

The Steel Venom is the world's first vertical spiraling coaster! This ride is a "back-and-forth" coaster where the train of cars is accelerated forward to go up the front vertical track until gravity slows it down to a stop. It then falls backward down the front vertical track. It is accelerated again as it zooms backwards through the station before going up the back vertical track. This process is repeated for a total of three times up the front vertical track and two times up the back vertical track. Can you tell what surprise happened on the last time up the back hill?

F



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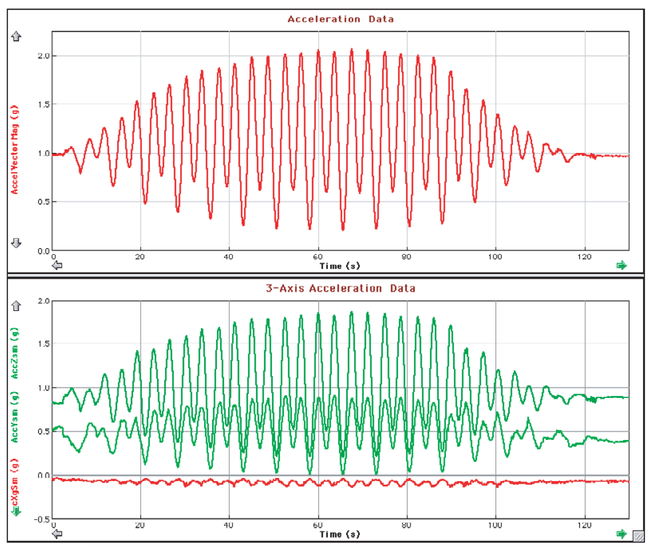

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3—BIG DIPPER

The Big Dipper is a historic wooden roller coaster with a first hill that is 65 feet high. This has a very regular series of hills and valleys.

4—BOUNTY

The Bounty is a pendulum type of ride with a large boat holding about 40 riders suspended below its horizontal axis. Motors push the boat back and forth until it is swinging about 90 degrees end to end. For the data shown here, was the rider sitting in the middle of the boat or at one end?

5—HEAD SPIN

The Mind Eraser is a steel-track roller coaster that consists of a half loop, half corkscrew, another half loop, then a complete loop. Then it reverses to do it all again backwards over the same track! The maximum height is 125 feet.

6—TIME WARP

The Time Warp has a car that can rotate 360 degrees at the end of a 25-foot main arm. The main arm also rotates 360 degrees . The relative rotation rate between the car and the main arm is twice the rotation rate of the main arm relative to the Earth. The main arm is rotated back and forth and around in a predetermined pattern.

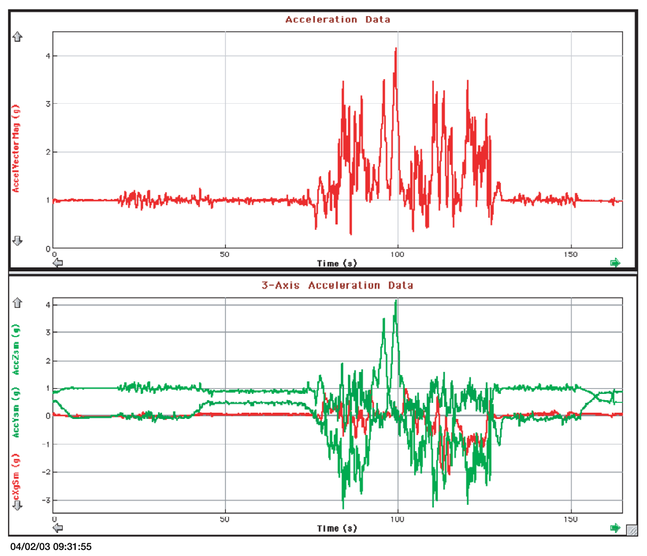
7—X-FLIGHT

The X-Flight is a steel-track roller coaster in which the train starts out in the station on top of the track, but at the top of the first hill, the track rolls 180 degrees which puts the train and riders under the track. At the start of the ride, the riders' seats also recline backward, which results in riders facing down for their "flight" through the ride. The train returns to the top of the track at the end of the ride and the riders are raised to a sitting position once again.

8—THUNDERHAWK

The Thunderhawk is a steel-track roller coaster with several inversions and loops. Pairs of side-by-side seats are suspended below the track and the riders' feet are dangling in the air. After the first tall hill, that first drop feels like falling straight down.

G



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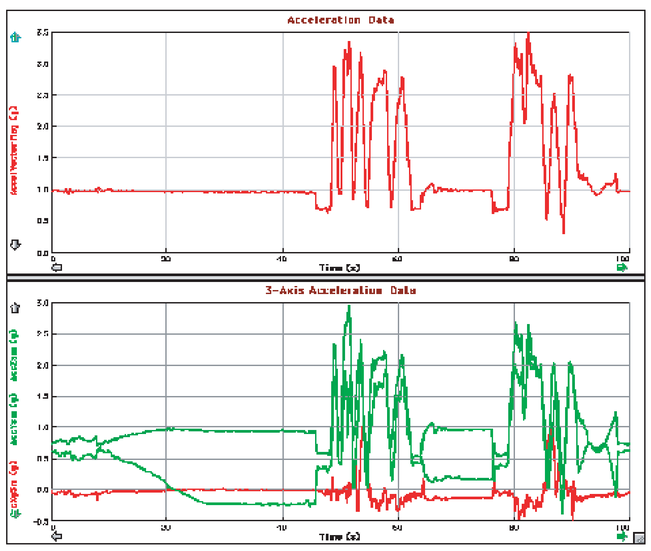

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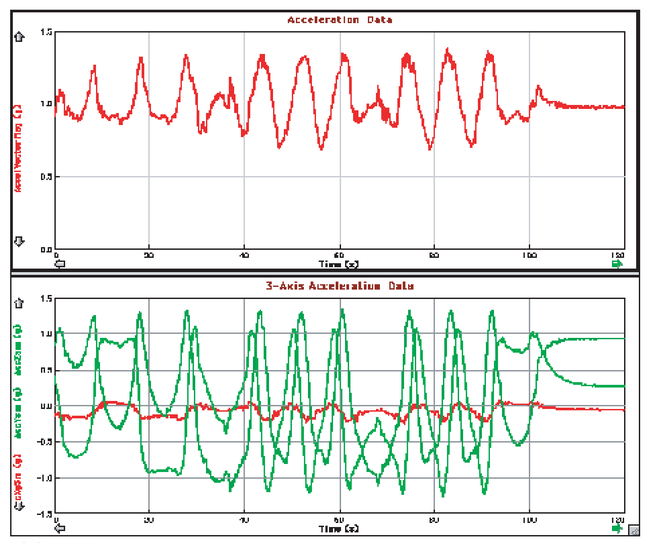

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